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NATURAL REINFORCEMENT: A WAY TO IMPROVE EDUCATION

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In 1984, B. F. Skinner wrote "The Shame of American Education," a paper that could have been titled "The Shame of World Education," because education is universally in a shameful condition. In his article, Skinner says, "Give the students and teachers better reasons for learning and teaching. That is where the behavioral sciences can make a contribution. They can develop instructional practices so effective and so attractive in other ways that no one—student, teacher, or administrator—will need to be coerced into using them" (p. 950). The science of behavior analysis already has made valuable contributions to education (Bijou & Baer, 1978; Heward, Heron, Hill, & Trap-Porter, 1984; Holland, Solomon, Doran, & Frezza, 1976; Keller, 1968; Skinner, 1968, 1973, 1989; Stewart & Vargas, 1990; Sulzer-Azaroff & Meyer, 1986; J. Vargas, 1977).

In 1980, Los Horcones community initiated a research project on alternatives to contrived or artificial reinforcement. The present paper summarizes procedures used within our community, and proposes the use of natural reinforcement as a way of maximizing the effectiveness of positive reinforcement in the field of education. The rationale for these procedures is related to our philosophy that possession and control of reinforcers by a particular individual or by a group interferes with our development as a Walden Two culture (Horcones, 1982a, 1982b, 1985, 1986a, 1986b, 1986c, 1989, 1991; Skinner, 1976). Contrived or artificial reinforcers can be manipulated or controlled easily by members or groups—so we needed an alternative to contrived reinforcement. We also wanted to identify reinforcers that individuals could receive without the mediation of another person, and that contribute to making the natural consequences of behavior reinforcing. As a result of this investigation, we have termed the alternative reinforcers "natural reinforcers."

Unfortunately, natural reinforcement often has not been experimentally studied from a behavior-analytic perspective, and the concept itself has been vague (cf. Ferster, 1967; Horcones, 1983; Kazdin, 1975; Skinner, 1957; J. Vargas, 1977).

DEFINING NATURAL REINFORCEMENT

The Concept of Consequence

The term *natural reinforcement* has been defined in various ways. The definition we use is based on the more general concept of *consequence*. The definition of the term *consequence* we propose refers to events produced by a behavior, whether or not they affect subsequent responding (Horcones, 1987). The concept of *postcedent* suggested by E. Vargas (1984, 1985) identifies a related concept: A postcedent follows responding whether or not it was produced by responding, and whether or not it affects subsequent responding.

Intrinsic and Extrinsic Consequences

Consequences can be classified as intrinsic or extrinsic according to their origin (Horcones, 1987). Intrinsic consequences originate in the behavior itself; they are the natural or automatic results of responding (Vaughan & Michael, 1982). For example, the repertoires we call knowing are intrinsic results of studying (Horcones, 1983). Extrinsic consequences originate in sources other than the be-

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havior itself; for example, getting an approving remark from a teacher. Both intrinsic and extrinsic consequences may or may not function as reinforcers.

Intrinsic consequences have also been called *natural consequences* (Horcones, 1983; Skinner, 1982; J. Vargas, 1977). Some behavior analysts define a natural reinforcer based on the setting in which it occurs (cf. Ferster, Culbertson, & Perrott, 1975; Kazdin, 1975; Sulzer-Azaroff & Mayer, 1977). Other behavior analysts define a natural reinforcer as an automatic product of behavior (cf. Skinner, 1957; J. Vargas, 1977; Vaughan & Michael, 1982). The problem associated with using the term *natural* to classify a reinforcer that is highly available in a particular setting is that what is natural varies across settings. We propose that when classifying an event as natural to use the second definition; that is, to consider only its relation to the behavior and not its relation to the environment. The definition we propose is: Intrinsic consequences are the changes in stimulation produced by the behavior itself. Thus, a behavior is naturally reinforced when the intrinsic consequences it produces function as reinforcers (Horcones, 1983).

ESTABLISHING A NATURAL REINFORCER

Because the natural reinforcer is an intrinsic consequence of the behavior, it cannot be manipulated deliberately. Obviously, each time the behavior occurs, the consequence occurs; in this sense, the consequence is automatic. Now, if the educator cannot manipulate the natural consequence of a specific behavior, what practical use does it have? The answer is that we can establish or eliminate the reinforcing function of natural consequences. We can also make them more or less conspicuous as a consequence of the behavior.

In the strategy of emphasizing natural reinforcement, extrinsic reinforcers still fulfill two objectives: first, to shape, increase, and maintain the behavior (behavior strengthening), and second, to condition the natural consequences as reinforcers (reinforcer strengthening). However, although we can condition a natural consequence as a reinforcer, it is more effective to use certain additional strategies (Horcones, 1983). We recommend the following sequence.

1. Select the target behavior.
2. Identify the natural consequences of the selected behavior.
3. Select intrinsic consequences to condition as natural reinforcers those that are most relevant to the educational setting. A particular student's behavior can have several intrinsic consequences, and not all of them are equally relevant. For example, intrinsic consequences of writing could be the noise made by the pencil when marking on the paper or the forms and size of the marks made on paper. This latter consequence is most relevant and should be the one conditioned as the natural reinforcer.
4. Identify the relevant intrinsic consequences that can be more easily observed by the student. Select from those relevant intrinsic consequences the most conspicuous to condition as natural reinforcers. For example, some relevant intrinsic consequences of the behavior of singing in a group are hearing oneself singing in the same key, volume, and words as the rest of the group. Of course, listening to oneself singing the same words as the rest is one of the consequences that can be more easily observed by the singer. It would be more difficult to discriminate whether one is singing in key or not. So, the teacher may first try to condition, as a natural reinforcer, the consequence of singing the same words, then, singing at the right volume, and finally, singing in the right key.
5. Arrange the conditions under which the intrinsic consequences occur in order to make them more easily observable for the students. From our point of view, making the natural consequences conspicuous is one of the most important functions of the educator. For example, when the student finishes solving a math problem, the teacher can point out and describe for the student the correct sequence followed by the student to arrive at the solution.

Another function of the educator, of course, in-

volves eliminating or reducing conditions that can interfere with the student's observation of the intrinsic consequences of his or her behavior. Care should be taken in the selection of reinforcers and their delivery to the student. Sometimes when a teacher delivers an extrinsic reinforcer, the teacher distracts the student from observing the natural consequences associated with studying.

6. Select appropriate back-up reinforcers. The success of conditioning an intrinsic consequence as a reinforcer can depend on the back-up reinforcer selected. Six recommendations for selecting the appropriate back-up reinforcer are: (a) The back-up reinforcer should be powerful. If the back-up reinforcer is powerful, conditioning will occur more rapidly. (b) The back-up reinforcer should have a high possibility of occurrence or high availability within the natural setting (Kazdin, 1975). (c) The back-up reinforcer should not interfere with the occurrence of the behavior or with the observation of its intrinsic consequences. (d) Whenever possible, the back-up reinforcer should be a connected reinforcer. A connected reinforcer is one that facilitates the performance of the behavior (Horcones, 1983). For example, crayons and coloring books are reinforcers connected to the behavior of coloring, whereas free time is a reinforcer not connected with this behavior. (e) The back-up reinforcer can be the opportunity to emit behaviors that are already naturally reinforced. This can be done, for example, by reinforcing the drawing of a student for whom it is naturally reinforcing to sing, by pairing the opportunity to sing with drawing (Premack, 1959). (f) The back-up reinforcer should be a participatory reinforcer whenever possible. A participatory reinforcer is one that involves the educator participating directly in the activity in which the target behavior occurs (Horcones, 1991).

7. Establish natural reinforcers. After the back-up reinforcer is selected, we begin conditioning the intrinsic consequences as reinforcers. To insure the maintenance of the reinforcing function of an intrinsic consequence, we have found the following strategies to be helpful: (a) Gradually remove back-up reinforcers from the situation while the teacher continues to point out and describe to the student the natural consequence. (b) Besides witholding the back-up reinforcers, it is necessary to decrease the teacher's behavior of pointing out and describing the natural consequences. (c) Deliver and intermittently pair the back-up reinforcer with the natural reinforcers.

Maintenance of Behavior through Natural Reinforcement

We believe the educator's function is not only to shape and maintain the student's behavior but is also to arrange for it to be maintained by natural consequences. Educators may find these nine steps helpful to maintain behavior under natural control.

Step 1. Constantly maintain the conditions that facilitate the emission of the naturally reinforced behavior and the observation of its natural consequences by the student. For example, a chemistry teacher not only provides students with materials necessary to carry out experiments but also maintains the conditions so students can easily observe the natural consequences resulting from their experimental behavior.

Step 2. Teach students how to maintain for themselves the conditions that facilitate the emission of the behavior and the observation of its natural consequences. For example, in the case of doing chemistry experiments, the educator teaches students to assemble in advance the materials needed to carry out the experiment until students eventually learn to set up the same required conditions.

Step 3. Make intermittent approving remarks about the natural consequence of a behavior even when the behavior is not being emitted. As an example, a teacher, after reading a student's written homework, says "It is nice when your handwriting is clear, because we both can understand what is written."

Step 4. Teach students to make approving descriptions of the natural consequences. The educator teaches students not only to observe these consequences but also to describe them positively.

Step 5. Avoid pairing natural reinforcers with aversive stimuli. For example, the educator avoids

criticizing a child when he is coloring and observing the drawing.

Step 6. Avoid putting naturally reinforced behavior under instructional control. Putting naturally reinforced behavior under instructional control makes it less probable to occur, because its occurrence will not be controlled by natural discriminative stimuli but instead by artificial discriminative stimuli—the instructions given by the teacher.

Step 7. Be careful not to interrupt students when they are performing the naturally reinforced behavior.

Step 8. Avoid asking students to perform the behavior when they are already satiated. The teacher avoids telling a student for whom drawing is naturally reinforced to make more drawings when the student has already stopped drawing.

Step 9. Avoid limiting the time for emitting a naturally reinforced behavior. Students must have enough time available to observe each of the natural consequences that result from their activity.

NATURAL VERSUS CONTRIVED REINFORCEMENT

Advantages of Natural Reinforcement

Some of the advantages of using natural reinforcers in the shaping and maintenance of students' behavior are as follows: Students' behaviors may be more rapidly shaped due to the immediacy of the reinforcer in natural reinforcement (Skinner, 1989). Natural reinforcers are available for all students at the same time. With contrived reinforcement it is almost impossible for the teacher to reinforce every behavior of every student at the most appropriate moment; with natural reinforcement this is possible.

Natural reinforcement may bring the behavior under the control of natural discriminative stimuli. The conditions under which the behavior is usually performed, rather than the teacher's instructions or presence, function as discriminative stimuli. Naturally reinforced studying behavior is thus likely to generalize beyond the school setting and beyond the presence of the teacher.

Natural reinforcement is individualized for each behavior. This feature reduces the possibility of satiation from a generalized reinforcer; if satiation does occur, it affects only the behavior that produces the particular reinforcer.

Disadvantages of Using Only Contrived Reinforcers

The negative effects of the exclusive use of contrived reinforcers in education are obvious. Students may stop studying when teachers stop reinforcing. Often the reinforcer for the student's behavior of attending the school is not to learn but to obtain an attendance mark or to avoid punishment for not attending.

Students rarely make novel things and explore new material; they often do only what is necessary to fill the teacher's requirements. They do not study more than required to pass the exam. Teachers often devote much energy to making the students study, and their behavior of teaching is frequently extinguished or punished by the student. Teaching comes to be controlled by reinforcers other than those associated with teaching.

CONCLUSION

There is nothing wrong with artificial or contrived reinforcement in itself (Horcones, 1983; Skinner, 1982). However, the success of shaping and maintaining a particular behavior depends largely on the type of reinforcers selected and on how and when they are delivered. Contrived reinforcers can be used in the educational setting to obtain more benefits for the student, the teacher, and the society as a whole, providing they are used not only to reinforce behavior but also to condition its natural consequences as reinforcers. In other words, contrived reinforcers can be more effectively used to teach reinforcers, not just behavior (as we say) "to reinforce reinforcers." By using the strategies outlined in this article, educators may be able to teach students to be reinforced *by studying* and not only *to study*. Natural reinforcement is, for educators, an available and reliable behavioral procedure, whose application, from our point of view, can significantly contribute to our efforts to improve

education. However, more research is needed in this area.

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